

**FIELD THEORIES OF CONDENSED MATTER PHYSICS (SECOND EDITION)**, Eduardo Fradkin, Cambridge University Press, 2013; pp. 838; ISBN: 978-0-521-76444-5; Price: \$100.95 USD.

**FORENSIC SEISMOLOGY AND NUCLEAR TEST BANS**, Alan Douglas, Cambridge University Press, 2013; pp. 514; ISBN: 978-1-107-03394-8; Price: \$132.95 USD.

**GRAVITATION AND SPACETIME (THIRD EDITION)**, Hans C. Ohanian and Remo Ruffini, Cambridge University Press, 2013; pp. 528; ISBN: 978-1-107-01294-3; Price: \$76.95 USD.

**INVISIBLE IN THE STORM: THE ROLE OF MATHEMATICS IN UNDERSTANDING WEATHER**, Ian Roulstone and John Norbury, Princeton University Press, 2013; pp. 346; ISBN: 978-0-691-15272-1; Price: \$29.78.

**MATHEMATICS OF QUANTIZATION AND QUANTUM FIELDS**, Jan Dereziński and Christian Gérard, Cambridge University Press, 2013; pp. 674; ISBN: 978-1-107-01111-3; Price: \$142.95 USD.

**MEASUREMENT, UNCERTAINTY AND PROBABILITY**, Robin Willink, Cambridge University Press, 2013; pp. 276; ISBN: 978-1-107-02193-8; Price: \$100.95 USD.

**NONEQUILIBRIUM MANY-BODY THEORY OF QUANTUM SYSTEMS: A MODERN INTRODUCTION**, Gianluca Stefannucci and Robert van Leewen, Cambridge University Press, 2013; pp. 600; ISBN: 978-0-521-76617-3; Price: \$96.95 USD.

**OPTICAL MAGNETOMETRY**, Dmitry Budker and Derek F. Jackson Kimball, Cambridge University Press, 2013; pp. 412; ISBN: 978-1-107-01035-2; Price: \$121.95 USD.

**QUANTUM CONCEPTS IN PHYSICS**, Malcolm Longair, Cambridge University Press, 2013; pp. 443; ISBN: 978-1-107-01709-2; Price: \$70.95 USD.

**STOCHASTIC CALCULUS AND DIFFERENTIAL EQUATIONS FOR PHYSICS AND FINANCE**, Joseph L. McCauley, Cambridge University Press, 2013; pp. 206; ISBN: 978-0-521-76340-0; Price: \$96.95 USD.

**TOPOLOGICAL INSULATORS AND TOPOLOGICAL SUPERCONDUCTORS**, B. Andrei Bernevig with Taylor L. Hughes, Princeton University Press, 2013; pp. 288; ISBN: 978-0-691-15175-5; Price: \$51.28.

**TRANSMISSION LINES**, RICHARD COLLIER, Cambridge University Press, 2013; pp. 318; ISBN: 978-1-107-02600-1; Price: \$96.95 USD.

## BOOK REVIEWS / CRITIQUES DE LIVRES

Book reviews for the following books have been received and posted to the Physics in Canada section of the CAP's website: <http://www.cap.ca>. When available, the url to longer versions are listed with the book details.

*Des revues critiques ont été reçues pour les livres suivants et ont été affichées dans la section "La Physique au Canada" de la page web de l'ACP: <http://www.cap.ca>. Quand disponible, un lien url à une critique plus longue est indiqué avec les détails du livre.*

**INTRODUCTION TO MODERN CLIMATE CHANGE**, Andrew E. Dessler, Cambridge University Press, New York, NY, U.S.A. 2012. pp. Xi + 238, ISBN: 978-1-107-00189-3 \$110.00 USD (hb), 978-0-521-17315-6 \$50.00 USD (pb).

This audacious book approaches the complex subject of climate change and the actions that should be taken to avert its possible disastrous consequences by addressing most of the questions commonly raised by those who deny or disbelieve the role of humans. The author assumes that his readers do not believe in science or in the content of scientific texts. The preface provides the raison d'être for the author writing this book. He believes that a modern democracy can only function effectively if its citizens are well educated so they can understand complex issues and ensure that good policy decisions are made.

The first chapter explores how people reach conclusions about complex subjects and how they can determine who is an authority on a subject. The medical analogue is used to discuss second opinions. This leads to a discussion of why nations joined together in 1988 to create the Intergovernmental Panel on Climate Change and the procedure by which the members of its committees are assembled and their reports are

written and vetted. The role of self-interest is explored using the example of companies and their shareholders who deny that human activity, and theirs in particular, do not harm the environment. The role of near unanimity in the development of scientific theories based upon intellectual integrity is evoked to debunk conspiracy theories.

The seven introductory chapters cover the background material necessary to understand climate change and global warming. Each chapter focuses on the essential scientific facts necessary to answer a carefully chosen typical question raised by deniers. These chapters are followed by seven others concerning the economic, policy and moral issues that arise because of climate change. Here again, the author is straightforward in addressing the various arguments that are advanced. The author's approach is simple but insightful and valuable because he carefully avoids bias in his examination of the various alternative solutions to these issues.

This book is the formalized version of the lecture notes for a first and second year non-science course the author taught at a Texas University. This reviewer doubts that many of the disbelievers the author targets will change their minds after taking a course using this text on the subject of human induced climate change and the related

societal issues. Nevertheless, it should be seriously considered as a valuable supplementary text for a non-mathematical course about climate change. It should be widely read and particularly by anyone involved in public governance since it provides the lay reader with an excellent summary of the basic science underlying this complex topic and an outline of how sound public policy concerning the serious consequences can be developed and implemented.

Harvey A. Buckmaster, P. Phys  
Adjunct Professor of Physics  
University of Victoria.

**NUMBER-CRUNCHING: TAMING UNRULY COMPUTATIONAL PROBLEMS FROM MATHEMATICAL PHYSICS TO SCIENCE FICTION**, Paul J. Nahin, Princeton University Press, 2011, pp. Xxvi + 376, ISBN: 978-0-691-14425-2 (hdbk), \$29.95 USD.

Arguably, no technology has had more of an impact on science than computers. Number-Crunching highlights the power of computation through several well-known mathematics and physics problems. The author Paul J. Nahin, an emeritus professor of electrical engineering at the University of New Hampshire, wrote this book as follow up to his best seller Mrs.

Perkins's *Electric Quilt: And Other Intriguing Stories of Mathematical Physics*.

*Number-Crunching* is a unique hybrid of a popular science book and textbook. Challenge questions are given at the end of each chapter and full solutions are provided at the end of the book. The author provides MATLAB code for the theories that are discussed. This is extremely useful as it allows the readers to reproduce the results and manipulate the codes themselves in order to gain a better understanding of the concepts presented.

There are several chapters dedicated to illustrating how computational methods have been used to study fundamental problems in physics. Hanging masses, the three-body problem, and electrical circuit analysis are all discussed. When available, analytical solutions are given along with their derivations. For each problem considered, numerical solutions are provided. This enlightens the reader as to why numerical methods are so powerful: when no equations are available, the system can be simulated; when equations are available, but are not amenable to analytic solution, numerical methods can be used to solve the equations; and even when analytic solutions exist, they are often difficult to obtain and it may be faster to go after the numerical solution right away.

The chapter on science fiction and computing was mainly comprised of a collection of short stories previously published by the author. Although entertaining, it was somewhat disconnected with respect to style and content from the rest of the book.

The book ends rather abruptly with a discussion of the fundamental limits of computation. The famous Halting problem posed by Alan Turing is used as an example. A discussion of the tradeoff between decreasing algorithmic and increasing round-off errors as the number of repeated operations  $N$  increases (round off error eventually dominates regardless of the degree of convergence of an algorithm) would have been appropriate to include in this chapter.

The book could have been strengthened by including a chapter on current research. For example, the life sciences are witnessing an invasion by physicists and mathematicians who

are determined to provide a theoretical framework for the largely data driven discipline. As biological systems are often noisy and nonlinear, analytical solutions are generally intractable and numerical methods and simulations are being employed at an unparalleled rate.

Overall, it is an interesting read and at times quite humorous. *Number-Crunching* would nicely complement a standard textbook for an undergraduate or graduate physics course in deterministic numerical methods (Monte Carlo methods are only mentioned briefly). This book should prove to be an enjoyable read to anyone who possesses a second year university level of physics and mathematics, a basic knowledge of programming, as well as an interest in learning through concrete examples why computational methods are invaluable to mathematics and science.

Daniel A. Charlebois, PhD Candidate  
University of Ottawa

**THE UNIVERSE AND THE ATOM**, Don Lichtenberg, World Scientific Publishing Co., 2007. pp XI + 301, ISBN-10 981-270-561-9 (pbk), \$44.50.

*The Universe and the Atom* is a book which seeks to discuss the natural world from the smallest (elementary particles) to the largest (the universe) scales. Aimed at a general audience, very few mathematical equations are shown in this book. Instead, physics concepts and phenomena are laid out using simple and straightforward descriptions. As a physics graduate student, I personally find mathematical descriptions very useful and thought the text could have used more of them, but that is my own bias! For the "physics enthusiast" who may not have a solid foundation in math, this book does well in conveying the take-home message of important physics principles in a few sentences.

The book is well organised and easy to read. Each chapter covers a particular physics topic (i.e. Newton's laws, relativity, the solar system, etc.), and begins with a relevant epigraph from a great scientific and/or artistic mind (Galileo, Feynman, and Joyce, to name a few). These topics are presented with historical context, and read more like a story

than a textbook. For example, the development of quantum mechanics is followed from Planck's quantisation of blackbody radiation, to de Broglie's particle-wave duality, to Schrodinger's equation, on to relativistic quantum mechanics.

One major complaint with this book is that considering the target audience, the diagrams and figures presented are overly simplified, black and white line drawings. Very boring! Some figures are not clear at all, and are more confusing than illustrative. As an example, when discussing the parabolic path of a thrown ball, a drawing of dots along a (parabolic?) curve is used as "clarification", totally absent of axes. When discussing the planets of the solar system, there is a comically crude figure of Saturn and its rings which looks like it was drawn in MS Paint in 30 seconds. Clear and visually attractive figures not only help to illustrate a problem or concept, but they enhance the reading experience. Considering the wealth of general physics books available, many with excellent illustrations, I'm surprised more effort was not put into this area.

One figure (Figure 16.2) was outright misleading. The figure consists of a Feynman diagram of electron-positron annihilation, showing the electron and positron annihilating into a single photon. The figure caption states that this interaction cannot happen in free space. As far as I know, this interaction can never happen, as it violates energy and momentum conservation (the electron and positron must annihilate into a pair of photons)! The text preceding this figure implies that electron-positron annihilation can only occur in the vicinity of another charged particle. While this is true for pair production (where an energetic photon converts into an electron and a positron), electron-positron annihilation can indeed occur in free space. Seeing as how Lichtenberg is a Professor Emeritus of particle physics at Indiana University in Bloomington, IN, I assume the confusion in this section was an oversight. Despite its shortcomings, this was an interesting book and it would appeal especially to those with a limited background in science.

Pete Watson  
McGill University

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Le comité de rédaction invite les lecteurs à soumettre des articles qui intéresseraient et seraient compris par tout physicien, ou physicienne, et étudiant ou étudiante en physique. Les articles de synthèse d'une longueur d'au plus quatre pages de revue sont en particulier bienvenus. Des suggestions de sujets pour des revues à thème sont aussi bienvenues et pourront être envoyées à [bjoos@uottawa.ca](mailto:bjoos@uottawa.ca).